

WATER-RESISTANT SHAPED STRUCTURE OF GYPSUM AND PROCESS FOR PRODUCTION THEREOF

BACKGROUND OF THE INVENTION

(1) Field of the Invention

This invention relates to a water-resistant shaped structure of gypsum and a process for the production thereof. More particularly, the invention relates to a shaped structure of gypsum excellent in the water resistance and durability thereof and a process for the production thereof.

Gypsum is known as a cheap construction material produced as a by-product in the exhaust gas desulfurization process, the waste sulfuric acid treatment process, the phosphoric acid production process and like processes. Shaped articles of gypsum, for example, so-called gypsum boards, are ordinarily prepared by kneading gypsum hemihydrate called "calcined gypsum" with water and optionally with reinforcers such as fibers to form a slurry, casting the slurry into a mold having a desirable form, hardening the slurry in the mold and drying the molded structure according to need. These shaped structures of gypsum are excellent in their sound insulating property, heat insulating property and other properties and they can be practically used as construction materials. However, these gypsum structures are defective in that when they fall in contact with water, especially running water, they are gradually dissolved out in water, resulting in extreme reduction of their volume. Therefore, these gypsum structures cannot be applied to uses where there is a fear of their falling into contact with water.

(2) Description of the Prior Art

Attempts have heretofore been made to improve the water resistance in shaped structures of gypsum. For example, Japanese Patent Application Laid-Open Specification No. 85,629/75 discloses a process comprising mixing water-hardenable gypsum with lime, forming a shaped structure of the mixture together with water, and heating and drying the shaped structure in the normal atmosphere or in an atmosphere containing carbon dioxide gas to effect aging and prepare a gypsum-lime hardened shaped structure. This gypsum-lime hardened structure has a lower water absorption than that of an ordinary gypsum hardened structure, and it has a relatively high strength even after it has absorbed water. However, if this gypsum-lime hardened structure is caused to fall in contact with running water, gypsum in the hardened structure is dissolved out into water and the surface portion of the structure is disintegrated or the volume of the structure is reduced (see comparative sample No. 7 shown hereinafter). Further, Japanese Patent Application Laid-Open Specification No. 139,117/75 discloses a process in which a hardened structure of gypsum is dipped in a solution of oxalic acid or sodium oxalate to form a water-resistant coating locally on the gypsum hardened structure. The amount of gypsum dissolved out into water in the so obtained gypsum structure is made much smaller than in a non-treated gypsum hardened structure, but it is impossible to reduce the amount of gypsum dissolved out into water substantially to zero. Further, the hardened structure of gypsum prepared according to the above known process is still insufficient in the point that considerable reduction of the volume is caused by contact with running water (see comparative sample 3).

So far as we know, there has not been developed a shaped structure of gypsum in which reduction of the volume is reduced to substantially zero when it is dipped in running water.

SUMMARY OF THE INVENTION

It is therefore a primary object of this invention to provide a water-resistant shaped structure of gypsum of which the volume is not substantially reduced even when it is dipped in running water for a long time, and a process for the production of such shaped structure of gypsum.

Another object of this invention is to provide a hardened shaped structure of gypsum which has a high resistance to reduction of its water resistance by heat strain, and a process for the production of such shaped structure of gypsum.

Still another object of this invention is to provide a process for preparing a shaped structure of gypsum which excels in water resistance and durability from an industrial waste as the raw material.

In accordance with this invention, there is provided a water-resistant shaped structure of gypsum comprising (A) calcium sulfate dihydrate formed by hardening of calcium sulfate capable of hydration reaction, (B) a calcium type filler for filling up spaces among crystalline particles of said calcium sulfate dihydrate and (C) a water-insoluble or hardly water-soluble salt of a polybasic acid having a second stage dissociation constant of 10^{-3} to 10^{-10} , especially 10^{-4} to 10^{-9} , as measured at 25°C ., said calcium type filler (B) being at least one calcium compound selected from the group consisting of calcium hydroxide, calcium carbonate, calcium silicate, calcium aluminosilicate, and non-water-hardenable anhydrous gypsum and partially hydrated products thereof, wherein the amount of the calcium type filler (B) and the water-insoluble or hardly water-soluble calcium salt (C) is 15 to 75% based on the total amount of the components (A), (B) and (C) as calculated as calcium, the amount of the water-insoluble or hardly water-soluble calcium salt (C) is 0.1 to 30% based on the total amount of the components (A), (B) and (C) as calculated as calcium, the water-insoluble or hardly water-soluble calcium salt (C) is distributed predominantly in the surface portion of the shaped structure, and said surface portion has a pore volume smaller than 0.50 ml/g in pores having a radius in the range of 75 to 75000 Å and a pore volume smaller than 0.20 ml/g in pores having a radius in the range of 4000 to 10000 Å.

In the instant specification and claims by the term "the filled Ca amount (C_1)" is meant a calcium concentration represented by the following formula:

$$C_1 = \frac{B + C}{A + B + C} \times 100$$

wherein A, B and C represent amounts of the above components (A), (B) and (C) as calculated as calcium.

In the instant specification and claims, by the term "the insoluble Ca amount (C_2)" is meant a calcium concentration represented by the following formula:

$$C_2 = \frac{C}{A + B + C} \times 100$$

wherein A, B and C are as defined above.

In accordance with this invention, there also is provided a process for the production of water-resistant